CLAIMS

What is claimed is:

1. A method for determining the distance between a first point and a second point on a storage medium, comprising the steps of:

(a) determining the distance between a first and a second read apparatus; and

(b) comparing the distance between the first point and the second points to the distance between the first and second read apparatus.

2. The method of claim 1, wherein the step of comparing includes the steps of:

(a) detecting the first point at the first read apparatus;

(b) detecting the second point at the first read apparatus;

(c) determining a jitter value in response to detection of the second point at the first read apparatus, the jitter value being representative of the distance between the first and second points;

(d) detecting the first point at the second read apparatus;

(e) determining a reference value in response to detection of the first point at the second read apparatus, the reference value being representative of the distance between the first and second read apparatus; and

(f) comparing the reference value to the jitter value.

3. A method for determining the distance between a first point and a second point on a storage medium, the first and second points being detectable by a leading and trailing read apparatus as the first and second points move past the leading and trailing read apparatus, the leading and trailing read apparatus being spaced apart a known distance, the method comprising the steps of:

(a) detecting the first point as the first point moves past the leading read apparatus;

(b) detecting the second point as the second point moves past the leading read apparatus;

(c) detecting the first point as the first point moves past the trailing read apparatus;

(d) measuring a ~~Referenee~~ Value starting from the detection of the first point at the leading read apparatus and ending upon detection of the second point at the leading read apparatus; and

(e) measuring a ~~Jitter~~ Value starting from the detection of the first point at the leading read apparatus and ending upon detection of the first point at the trailing read apparatus.

4. The method of claim 3, further including the step of storing the Jitter Value and the Reference Value associated with the pair of first and second points, and wherein each of the steps is repeated for each of a plurality of pairs of first and second points stored on the medium, such that a Jitter Value and a Reference Value are measured and stored in association with each pair of first and second points.

5. The method of claim 4, further including the step of calculating from each Jitter Value and a Reference Value, for each pair of first and second points stored on the medium, a Jitter Ratio.

6. The method of claim 3, further including the step of calculating a Jitter Ratio, the Jitter Ratio being proportional to the distance between the first and second points.

7. The method of claim 6, wherein detectable points are ideally stored on the storage medium at regular intervals of either one bit cell or one half bit cell in length and the distance between the leading and trailing read apparatus is equal to an odd multiple of one half the length of one bit cell.

8. The method of claim 7, wherein the distance between the leading and trailing read apparatus is equal to one half the length of one bit cell.

9. The method of claim 6, wherein calculating the Jitter Ratio includes the step of dividing the Jitter Value by the Reference Value.

10. The method of claim 9, further including the step of calculating the distance between the first and second points.

11. The method of claim 10, wherein the step of calculating the distance between the first and second points includes the step of multiplying the Jitter Ratio by the distance between the leading and trailing read apparatus.

12. The method of claim 6, wherein the leading and trailing read apparatus is a magnetic read head.

13. The method of claim 12, wherein the magnetic read head includes a pickup coil and a zero crossing detector.

14. The method of claim 13, wherein the magnetic read head further includes a current amplifier.

15. The method of claim 6, wherein each of the steps are repeated for each of a plurality of pairs of first and second points, such that a list of Jitter Ratios is produced, each Jitter Ratio being proportional to the distance between each of the pairs of first and second points stored on the storage medium.

16. The method of claim 15, further including the step of multiplying each Jitter

Ratio by the distance between the leading and trailing read apparatus to determine the distance between each pair of first and second points.

17. The method of either claim 5, further including the step of generating a Jitter Signature from the Jitter Ratios.

18. The method of claim 5, further including the step of generating a Jitter Signature from a selected subset of Jitter Ratios.

19. The method of claim 18, wherein the selected subset of Jitter Ratios includes those Jitter Ratios which indicate at least one predefined range of deviations from an ideal distance between the associated first and second points.

20. The method of claim 19, wherein a first predefined range of deviations includes deviations which exceed a predefined value, and a second predefined range of deviations include deviations which do not exceed the predefined value.

21. The method of claim 17, further including the step of Jitter Modulating the Jitter Signature.

22. The method of claim 17, further including the step of storing new points on the storage medium by spacing pairs of adjacent new points at a non-integer multiple of a predetermined reference distance, wherein a difference between the spacing of each pair of adjacent points and a closest integer multiple of the predetermined distance representing the Jitter Signature.

23. The method of claim 22, wherein a plurality of said differences between said spacing of a plurality of pairs of said adjacent points and said closest integer multiple represent one unit of information within the Jitter Signature.

24. The method of claim 3, further including the steps of:

(a) detecting a reference point before the detection of the first and second points at the leading read apparatus;

(b) setting a count value in response to the detection of the reference point;

(c) incrementing the count value each time a point is detected at either the leading or trailing read apparatus;

(d) storing the measured Reference Value together with the present count value at the time the second point is detected at the leading read apparatus; and

(e) storing the measured Jitter Value together with the present count value at the time the first point is detected at the trailing read apparatus.

25. The method of claim 24, further including the step of generating a Jitter Ratio after both the Reference Value and the Jitter Value have been stored.

26. The method of claim 25, further including the step of storing the Jitter Ratio together with the count value present at the time the first point is detected at the trailing read apparatus.

27. A method for correcting the location of a transition from a first logical state to a second logical state stored on a storage medium in which each correctly located transition is located a predetermined distance from a preceding correctly located transition, and a first correctly located transition and a second transition are detectable by a leading and trailing read apparatus as the first and second transitions move past the leading and trailing read apparatus, the leading and trailing read apparatus being spaced apart a known distance, including the steps of:

(a) detecting the first correctly located transition as the first transition moves past the leading read apparatus;

(b) detecting the second transition as the second transition moves past the leading read apparatus;

(c) detecting the first transition as the first point moves past the trailing read apparatus;

(d) measuring a ~~Reference~~ Value starting from the detection of the first transition at the leading read apparatus and ending upon detection of the second transition at the leading read apparatus; and

(e) measuring a ~~Jitter~~ Value starting from the detection of the first transition at the leading read apparatus and ending upon detection of the first transition at the trailing read apparatus;

(f) calculating the distance between the first and second transitions based upon the Reference Value and the Jitter Value;

(g) comparing the calculated distance with the correct distance to determine a location error;

(h) if the location error is greater than a predetermined value, then rewriting the second transition at the correct location.

28. An apparatus for characterizing the distance between a first point and a second point stored upon a storage medium, the apparatus including:

(a) a first read apparatus;

(b) a second read apparatus spaced a predetermined distance from the first read apparatus;

(c) a counter for measuring a Reference Value which elapsed between detection of the first point at the first read apparatus and detection of the first point at the second read apparatus, and for measuring a Jitter Value which elapsed between detection of the first point at the first read apparatus and detection of the second point at the second read apparatus; and

(d) a processing device for determining the quotient of the Jitter Value divided by the Reference Value.

29. An electronic chip card for securely storing information, including:

(a) an electronic storage ; and

(b) a second FIFO, coupled to the processing device, for storing the Jitter Values.

30. An apparatus for characterizing the distance between a first flux transition and a second flux transition stored upon a storage medium, the apparatus including:

(a) a first read apparatus for outputting a signal which indicates detection of a flux transition;

(b) a second read apparatus spaced a predetermined distance from the first read apparatus for outputting a signal which indicates detection of a flux transition;

(c) a first transition detector, coupled to the first read apparatus, for detecting the indications of the output from the first read apparatus and outputting an indication in response thereto;

(d) a second detector, coupled to the second read apparatus, for detecting the indications output from the second read apparatus and outputting an indication in response thereto;

(e) a counter for determining a Reference Value equal to the difference between the count at detection of the first point at the first read apparatus and the count at detection of the first point at the second read apparatus, and for determining a Jitter Value equal to the difference between the count at detection of the first point at the first read apparatus and the count at detection of the second point at the second read apparatus; and

(f) a processing device for determining a quotient of the Jitter Value divided by the Reference Value.

31. The apparatus of claim 30, further including:

(a) a first FIFO, coupled to the processing device, for storing the Reference Values; and

(b) a second FIFO, coupled to the processing device, for storing the Jitter Values.

32. The apparatus of claim 30, further including a clock generator, coupled to the first and second transition detectors, for generating a clock having a change in logical state each time an indication is detected by either the first or the second transition detector.

33. The apparatus of claim 32, further including an identification means, coupled to the first and second transition detectors, for identifying a reference pattern stored on the storage medium, setting a count value, and incrementing the count value each time either the first or the second transition detector detects an indication.

34. The apparatus of claim 30, wherein the first and second read apparatus includes:

(a) a pickup coil; and

(b) a current zero crossing detector, coupled to the pickup coil.

35. The apparatus of claim 33, wherein the first and second read apparatus further include a current amplifier coupled between the pickup coil and the current zero crossing detector.

36. An apparatus for characterizing the distance between a first transition and a second transition stored upon a storage medium, the apparatus including:

(a) a first read apparatus for detecting a transition and outputting a signal in response to detecting the transition;

(b) a second read apparatus spaced a predetermined distance from the first read apparatus for detecting a transition and outputting a signal in response

to detection of the transition;

(c) a third read apparatus spaced a predetermined distance from the second read apparatus for detecting a transition and outputting a signal in response to detection of the transition;

(d) a first transition detector, coupled to the first read apparatus, for detecting the signal output from the first read apparatus and outputting a signal in response thereto;

(e) a second detector, coupled to the second read apparatus, for detecting the signal output from the second read apparatus and outputting a signal in response thereto;

(f) a half bit cell reference value counter for determining a Reference Value equal to the difference between the count value at detection of the first point at the first read apparatus and the count value at detection of the first point at the second read apparatus,

(g) a jitter value counter for determining a Jitter Value equal to the difference between the count value at detection of the first point at the first read apparatus and the count value at detection of the second point at the second read apparatus;

(h) a whole bit cell reference value counter for determining a Whole Bit Cell Reference Value equal to the difference between the count value at detection of the first point at the first read apparatus, and the count value at detection of the first point at the third read apparatus; and

(i) a processing device for determining a quotient of the Jitter Value divided by either the Whole Bit Cell Reference Value or the Half Bit Cell Reference Value.

37. The apparatus of claim 36, wherein the processing device determines the quotient of the Jitter Value divided by the Whole Bit Cell Reference Value if the second point is not detected at the first read apparatus before the first point is detected

at the third read apparatus.

38. The apparatus of claim 36, wherein the processing device determines the quotient of the Jitter Value divided by the Half Bit Cell Reference Value if the second point is detected at the first read apparatus before the first point is detected at the second read apparatus.

39. The apparatus of claim 36, wherein the processing device determines whether the quotient is to be equal to the Jitter Value divided by the Half Bit Cell Reference Value or the Jitter Value divided by the Whole Bit Cell Reference Value, depending upon which resulting quotient is closer to an integer value.

40. An apparatus for characterizing the distance between a first transition and a second transition stored upon a storage medium, the apparatus including:

(a) a reference read apparatus for detecting a transition and outputting a signal in response to detecting the transition;

(b) a plurality of measurement read apparatus, each spaced a known distance from the reference read apparatus, for detecting a transition and outputting a signal in response to detection of the transition; and

(c) a processing device for determining the distance between the first and second point as a function of the particular measurement read apparatus which provides an output signal most nearly simultaneous to the generation of the output signal from the reference read apparatus.

41. The apparatus of claim 40, wherein the distance between each measurement read apparatus and the reference read apparatus is available to the processing device, and the processing device determines that the distance between the first and second point to be equal to the distance between the reference read apparatus and the particular measurement read apparatus which provided an output signal most

nearly simultaneous to the generation of the output signal from the reference read apparatus.

42. The apparatus of claim 40, wherein the processing device is further for determining whether the quotient is to be equal to the Jitter Value divided by the Half Bit Cell Reference Value or the Jitter Value divided by the Whole Bit Cell Reference Value, based upon placement of points which occur before and after the second point.

43. A secure data storage system including:

(a) a first memory means for storing information; and

(b) a second memory means on which data is spatially encoded;

wherein the information that stored in the first memory means is encrypted using a jitter signature derived from deviations in the spacing of the data encoded on the second memory means.

44. A method for securing and authenticating data and a medium on which the data is stored, including the steps of:

(a) spatially encoding data on a medium;

(b) calculating a jitter signature associated with the data spatially encoded on the medium; and

(c) encrypting the information stored on a memory means using the jitter signature as the encyption key.

45. A method for securing and authenticating data and a medium on which the data is stored, including the steps of:

(a) spatially encoding data on a medium;

(b) calculating a jitter signature associated with the data spatially encoded on the medium; and

(c) storing the jitter signature in a memory means.

46. A chip card for securely storing information, including:

(a) a memory device having data encrypted with a jitter signature derived from a series of spatial relationships of spatially encoded data; and

(b) a medium, fixed to exterior of the memory device, for storing the spatially encoded data.